



INDEPENDENT EXTERNAL PEER REVIEW PANEL

for the Coastal Texas Protection and Restoration Integrated Feasibility Report & Environmental Impacts Statement

The U.S. Army Corps of Engineers submits the following information per requirements in the Water Resources Reform and Development Act of 2014, Section 1044(c)(4)(B).

Entity Conducting the Review	
Outside Eligible Organization:	Battelle 505 King Avenue Columbia, OH 43201
Dates of Review	
Review Initiation:	6 June 2018
Type I IEPR Final Report Submittal:	15 January 2019
Reviewer Names and Qualifications	
David Luckie	Civil Works Planner/Economist
<p>Mr. Luckie is an independent consultant with 29 years of professional experience in water resource economics, planning, plan formulation, benefit-cost analysis, and risk-based analysis. His public works experience encompasses decades of work with Federal and non-Federal agencies, as well as local and state organizations. He earned his B.S. in economics and finance from the University of South Alabama in 1986. His professional experience includes working with multidisciplinary teams to provide or review complex planning studies for coastal storm risk management (CSRМ), dam safety, flood risk management (FRM), ecosystem restoration, and water supply and water quality studies. He is intimately familiar with Engineer Regulation (ER) 1105-2-100 and the 6-Step Planning Process and has prepared, supervised, or reviewed numerous planning studies in his career. Mr. Luckie is familiar with the evaluation of alternative plans for both CSRМ and FRM studies and has conducted, supervised, or reviewed several water resource studies featuring numerous alternative plans constructed from an array of different management measures. Over the last three decades, Mr. Luckie has been involved in numerous CSRМ studies. Two examples are the Panama City Beach, Florida, study, a multipurpose project that included structural, non-structural, and recreation outputs, and the Mississippi Coastal Improvements Program following Hurricanes Katrina and Rita. He has also served as a panel member on the IEPRs of the Hereford Inlet CSRМ Study in New Jersey and the Encinitas – Solana Beach CSRМ Study in California. He applied his knowledge of ER-1105-2-100 and the 6-Step Planning Process in each of these high-profile efforts. Least cost analysis, also known as cost-effectiveness analysis, has been a very important aspect of Mr. Luckie’s decades of work. He is familiar with the evaluation of alternative plans. As a Regional Economist with the USACE Mobile District (1988-2006), Mr. Luckie conducted, supervised, or reviewed benefit-cost analyses for a variety of water resource projects, both single-purpose and multi-purpose projects covering the full range of USACE missions. Relevant studies include the Apalachicola-Chattahoochee-Flint River and the Alabama-Coosa-Tallapoosa Comprehensive Studies; the draft Programmatic Environmental Impact Statements covering the states of Alabama, Florida, and Georgia; and the Hunting Bayou General Reevaluation Report (GRR) in Houston, Texas. Mr. Luckie is very familiar with USACE standards and procedures. He has extensive experience in performing</p>	

National Economic Development (NED) analyses, specifically as they relate to flood and coastal risk management. For more than 25 years, he has performed, supervised, or reviewed NED procedures for technical accuracy and for compliance with policy, guidance and accepted planning principles. Such studies as Panama City Beaches and Mississippi Coastal Improvements reflect this expertise. Mr. Luckie has been using the Hydrologic Engineering Center Flood Damage Reduction Analysis (HEC- FDA) software since its inception in the 1990s. He has also performed, reviewed, or trouble-shot scores of HEC-FDA analyses for Federal, non-Federal, and private sector clients. In addition, he has mentored interns and junior economists in USACE methodologies for CSRSM, requiring them to calculate without- and with-project condition damages, either by hand or with a Microsoft Excel spreadsheet, before allowing them to use HEC-FDA. He is also very familiar with the USACE Regional Economic System (RECONS) model and the estimation of Regional Economic Development benefits, and has used the model for both Federal and non-Federal project proponents since its inception.

Shaye Sable, Ph.D

Ecological Modeler

Dr. Sable, an aquatic/fisheries ecologist and modeler with Dynamic Solutions, LLC, has 17 years of experience developing sampling and modeling frameworks and analyses for water resource planning and design projects and resource management. She received a Ph.D. in oceanography and coastal sciences with a minor in experimental statistics from the Louisiana State University in 2007, and a B.S. in biology from the Ohio State University in 1997. Dr. Sable has previously performed development and testing of Habitat Suitability Indices (HSI), Habitat Evaluation Procedures (HEP), Wetland Value Assessments (WVA), benthic indices, diversity indices, univariate and multivariate statistical models, and numerical simulation models of fish populations and food webs for the USACE Mississippi Valley and South Atlantic Districts. In 2009, she led the multivariate and spatial statistical analyses of the fisheries-independent monitoring data to evaluate habitat associations, temporal and spatial changes and trends in relative abundance of key fish and shellfish species for the region as part of the USACE Mississippi River-Gulf Outlet Draft Environmental Impact Statement project. She has analyzed large hydrologic, environmental, and biological data sets using many univariate and multivariate statistical methods and numerical modeling methods for various ecosystem and coastal restoration projects. For example, she is working on the Mid-Barataria Sediment Diversion Project Environmental Impact Statement, Barataria, Louisiana, where she is reviewing the water quality, phytoplankton, vegetation, and ecological modeling analyses used by the State of Louisiana to evaluate impacts from the diversion on the estuary. She has linked her numerical models to time series data of environmental conditions, and hydrodynamic models such as DELFT, EFDC, RMA, and ADH to explore how river diversions, nutrient enrichment and removal, and habitat degradation and restoration affect species production and food web interactions in coastal ecosystems. Dr. Sable has extensive experience in applying fish population and community, food web, and ecosystem models to evaluate species responses to changing environmental conditions, habitat restoration, climate change, and stressors such as invasive species and exposure to toxicants. Dr. Sable assisted with the planning evaluation for the Twin Marsh Wetland Reserve Hydrologic Restoration Plan of Operation in Indian River County, Florida. She supported field efforts to map the existing wetlands, hydrology, surface and ground water sources and supply, and fish and wildlife to determine the ecological impacts. The planning evaluation of the wetland hydrologic restoration alternatives included a surface water modeling analysis to determine which operation plan led to recovery of native wetlands and prevention of invasive species. Prior to joining Dynamic Solutions, Dr. Sable was a research biologist with the Louisiana Department of Wildlife and Fisheries (LDWF), where she primarily conducted analyses of the fisheries-independent and dependent monitoring data to support the state's fisheries management measures and stock assessments; assessed and re-designed LDWF field monitoring protocol; provided technical advice, numerical modeling, and analyses to Louisiana Coastal Area (LCA) habitat restoration projects; and developed grant and research proposals for the Grand Isle

Fisheries Research Laboratory. Dr. Sable has experience developing and applying aquatic community and food web models and linking them to hydrodynamic and water quality data and models in order to simulate lower trophic level dynamics in the San Francisco Estuary and upper trophic level (fish) dynamics in Louisiana estuaries. She has experience developing HSIs, bioenergetics models, fish population and community models using matrix projection models and individual-based models, and food web models using the Comprehensive Aquatic System Model (CASM) approach (San Francisco Estuary and Barataria Basin, Louisiana). She also has experience coupling ecological and fish models with hydrodynamic and water quality models. She has extensive experience in developing numerical models in FORTRAN and in the analysis of large data sets with SAS. Dr. Sable has provided technical support, analyses, and review for the Environmental Impact Statements (EISs) written for the Caernarvon and the Davis Pond Diversion Projects in Louisiana. In addition, she has reviewed and provided strategies for improving Wetland Value Assessment, HSI, and statistical analyses for determining ecological benefits and impacts for Louisianan estuarine systems.

Felicia Rein Orah, Ph.D.

Environmental Law Compliance Expert

Dr. Rein has 29 years of professional environmental management experience implementing large-scale multidisciplinary research and evaluation projects. Currently a researcher and Affiliate Professor of geosciences for Florida Atlantic University, she earned a Ph.D. in ecosystem science and water resource management from the University of California, Santa Cruz, in 2000 and a B.S. in biology, environmental science, and English from Tufts University in 1988. Dr. Rein's areas of expertise include water quality, river science, watershed management, ecological monitoring, impact assessment, and ecological restoration, with a focus on ecological and biological sciences and National Environmental Policy Act (NEPA) assessment. Dr. Rein's experience is focused on water resource management and environmental evaluation. Her primary expertise is in ecosystem science, but her interdisciplinary doctoral program included environmental policy and economics. She has prepared and reviewed NEPA documents for two environmental planning firms and has served on past IEPR panels as biology and environmental compliance analyst. She has experience with coastal storm risk management (Encinitas-Solana Beach Coastal Storm Damage Reduction Project) and ecosystem restoration (Delta Islands and Levees Feasibility Study, Sacramento, California; and Jamaica Bay Feasibility Report IEPR). Dr. Rein is familiar with ecological studies and potential impacts on habitat, fish and wildlife species, as well as tribal cultures and archeology that may be affected by project alternatives. In more than 25 years of experience managing projects, many along the Pacific coast, she has gained experience with coastal ecology, including beach erosion, wetlands and riparian habitats, and ecologic restoration, specializing in the land-water interface. Her doctoral research was conducted in Elkhorn Slough, which drains into the Monterey Bay, where she investigated grass buffer strips as a best management practice (BMP) to reduce agricultural non-point-source pollution and improve water quality from conventional agricultural activities. Working as a senior project manager for Denise Duffy & Associates, Dr. Rein was based in Monterey, California, and worked in environmental impact assessment, analyzing impacts of dozens of projects on the Pacific Coast. These projects involved analyzing environmental trade-offs for threatened species, water resources, and other land uses; developing mitigation plans; conducting wetland delineations; and monitoring construction sites for erosion control compliance. Dr. Rein has worked for the Port Authority of New York and New Jersey, assessing impacts on both habitat and specific species potentially resulting from dredging activities. This project required environmental analysis to mitigate cumulative effects of a 5-year dredging program to deepen the NY-NJ harbor and ensure the economic viability of the port through blasting operations to deepen the channels and harbor while protecting threatened habitats. Solutions included defining cost-effective mapping of limited dredging operation windows in specific locations during nesting season. She has also managed a project on the Carmel River in California at the California State Water Resource Control Board dealing with a complex multi-objective environmental study.

Cumulative impacts of an existing on-stream lake in Carmel Valley, central Pacific Coast, was analyzed to balance water right claims, wetland habitats and competing endangered species habitat trade-offs, focused on the California steelhead salmon and the California red legged frog. Dr. Rein is experienced with the IEPR process and has participated in project reviews that included technical models estimating fluvial delivery into the system and optimizing hydrodynamics to rehabilitate jetties and reduce storm erosion. Dr. Rein has extensive experience preparing planning documents such as environmental impact reports (EIRs) and environmental impact statements (EISs) and has experience with all National Environmental Policy Act (NEPA) EIS requirements. She also has experience with the Endangered Species Act, essential fish habitat, and the Marine Mammals Protection Act. During her career, Dr. Rein has written or reviewed NEPA documents that have analyzed existing archeology and potential impacts and also has specific experience with tribal culture. At the Site One Impoundment project in Florida, human remains potentially from a tribe member were found, and a protocol to communicate with the tribe regarding the remains was initiated. Under the terms of the protocol, the area was protected and kept dewatered to ensure that no impacts occurred. In addition, as project manager of a mine reclamation study mentioned above for the Pala band of Mission Indians on tribal lands in northern San Diego County, she developed a familiarity with the area's tribal culture. Dr. Rein's expertise includes compliance with environmental laws, policies, and regulations. As a consultant, she has been awarded many projects dealing with environmental compliance monitoring. Her firm is responsible for all aspects of conducting required monitoring and maintaining compliance with permits, regulations, and laws. As a reviewer, she has extensive experience evaluating documents for NEPA compliance. Dr. Rein has had specific experience with the U.S. Fish and Wildlife Service (USFWS) on interagency coordination for several projects in compliance with the Fish and Wildlife Coordination Act. She also has managed projects that required expert knowledge of the Clean Water Act; these projects focused on wetland restoration or protection, wastewater discharge, and water quality protection. In addition, she has managed projects involving compliance with the Endangered Species Act, both in field monitoring and report preparation and review. For example, the project in Carmel, California, required an assessment of two species with conflicting habitat needs (the threatened red-legged frog and the endangered steelhead salmon) for compliance with the Endangered Species Act. Dr. Rein is also familiar with the USFWS Habitat Evaluation Procedure (HEP). Dr. Rein is familiar with the Standardized Assessment Methodology (SAM) and the Combined Habitat Assessment Protocols (CHAP) habitat evaluation model.

Alan Hall, D. WRE, P.E.	Hydrology & Hydraulics/Coastal Engineer
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Mr. Hall is an independent consultant with more than 40 years of experience in the fields of water resources, environmental, and civil engineering in government service and private practice. He currently provides watershed-scale water resources consulting services to public and private client groups. He earned his B.S. in engineering management from NOVA Southeastern University in 1986, is a registered professional engineer in Florida, and a Diplomate of the American Academy of Water Resource Engineers. He completed numerous graduate studies in Professional Engineering Management from the University of South Florida. Mr. Hall is a well-known expert in hydrology and hydraulics and has developed hydrologic methods that were adopted by the USDA-NRCS (aka SCS) for their National Field Engineers Handbook. For the State of Florida, he developed a hydraulic model for rapid planning analysis of capacities of alternative conveyance components. As an independent consultant, Mr. Hall led the hydrologic and hydraulic modeling of a large coastal urbanizing watershed in Florida using the full suite of HEC models (HEC- HMS, HEC-RAS, and HEC-FDA) to identify the “with- and without- project” conditions for the Federal flood control project that identified future development plans and damage reduction options. He also led the modeling efforts for damage reduction analysis of coastal flood protection plans on the southwest coast of Florida, which subsequently produced the appropriate Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) for the communities in Lee and Collier

Counties. Mr. Hall is familiar with large, complex water resources projects with high public and interagency interests and has managed over \$2 billion in water resources programs. For example, while serving as the Deputy Director of Planning for the South Florida Water Management District (SFWMD) (1983-1988), he led the agency efforts for the development of Regional Water Supply Plans to identify and plan for the water needs of over 6 million municipal customers, over 1 million agricultural acres, electric power suppliers, and recreational customers. As the Deputy Director of Operations & Maintenance (1988-1994), he oversaw a \$15 billion water control system. He also served as the SFWMD Director of Ecosystems Restoration (1994-1999), managing more than a billion dollars in ecosystems restoration planning, design and construction projects. Mr. Hall's specific accomplishments with SFWMD included the design and implementation of the Everglades Construction Project and Florida Bay Restoration, and the Emergency Interim Project. Several projects in New Orleans, Louisiana required his expertise in civil engineering, water resources engineering, and operations and maintenance. Mr. Hall served in multiple professional capacities as an IEPR panel member to oversee the design and construction of the Gulf Intracoastal Waterway Closure Complex (GIWCC) project. Included within the study were flood control pumping stations, a waterway closure gate, extensive levees and hurricane protection walls, and an environmentally sensitive water control structure. Mr. Hall is experienced in the USACE water supply storage reallocation process for Federal water projects and has worked on multiple USACE water supply and flood control projects in Ohio, West Virginia, Louisiana, and Florida. Relevant studies include the Supply-Side Management Plan for South Florida. He was the sole author of this management and operations plan to meet the needs of over 6 million urban customers, over one million acres of agricultural production, power supplies and the recreational and environmental needs for two million acres. This manual has been in use for the past 25 years and established the rule curves for the use of a four-million-acre-foot Federally constructed reservoir during both flood and drought conditions. The water control system controlled by this manual is valued at approximately \$15 billion. On another project, Mr. Hall served as an operations expert on the design, construction, and operation IEPR for a dam system, with a design capacity of more than 1,000,000 cfs that served the flood control and water supply needs in southern West Virginia. Mr. Hall is familiar with the development and evaluation of alternative plans for water supply for municipal and industrial uses, to include both surface and groundwater sources, and he has led regional water supply planning efforts that included surface and groundwater sources and their interconnections. Studies include the Central & South Florida Flood Control Project, where he developed the models, rule curves, and operation manuals for storage and distribution of water supplies for a system that included a 700 square mile reservoir with multiple water storage units upstream. He also wrote and implemented the manuals for flood control and water supply management for a system that delivered water to over six million residents from Orlando to Key West, Florida and for over 1.5 million acres of agricultural areas. Mr. Hall has experience working in states under both Eastern and Western systems of water rights in numerous studies throughout the United States. He served as an advisor to the General Manager of the Metropolitan Water District of Southern California during an initiative to drought-proof supplies for the future. He also served on a project team as an expert in hydraulic design and management to develop new water supplies for the environment, urban, agricultural, and power utilities for southern Florida in support of the Central Everglades Planning Project (CEPP). He served as the Deputy Planning Director of the SFWMD to manage the development of regional water supply plans to provide for all of the regional water supply needs in the future. Mr. Hall is also experienced in water resources studies at Federal multipurpose reservoir projects as defined in USACE Engineer Regulation (ER) 1105-2-100. ER 1105-2-100 was the basic set of regulations for the processes, procedures, and criteria that were used for the CEPP (that was completed in 2014) and has been the guidance on almost all project feasibility studies in which he has participated. Mr. Hall's understanding of the application of ER 1105-2-100 is also demonstrated through his participation on several USACE IEPR projects as a civil and operations and maintenance expert for such studies as

the WBV 14C.2 - New Westwego Pump Station to Orleans Village - 3RD Enlargement - Phase 1 and the Gulf Intracoastal Waterway (GIWW) West Closure Complex (WCC).

Christopher Brown, Ph.D., P.E.

Geotechnical Engineering

Dr. Brown is an associate professor at the University of North Florida (UNF), teaching courses in civil engineering, fluid mechanics, hydraulics, senior design, foundation engineering, and engineering geology. He earned his Ph.D. in civil engineering in 2005 from the University of Florida, M.A. in civil engineering (geo-environmental concentration) in 1997 from Villanova University, and a B.S. in civil engineering from Temple University in 1991. Dr. Brown is a licensed, practicing professional engineer in Florida and Pennsylvania focusing on water resources and geotechnical engineering. Dr. Brown has 29 years of civil engineering experience, which includes planning, design, construction, inspection, and teaching, working with and for USACE (Philadelphia District, 1991-1999, and Jacksonville District, 1999-2006), as well as municipal governments and private engineering firms. Dr. Brown has worked on a wide variety of large public works projects including dams, levees, shore protection, coastal structures, navigation (e.g., dredging and lock/dam projects), and environmental restoration (e.g., Everglades Restoration work). Dr. Brown has worked on several large channel modification projects as both a design engineer and peer reviewer. For the Molly Ann's Brook project in Haledon/Patterson, New Jersey, he worked on excavation plans, retaining wall design, and helped with the underpinning of existing buildings near the modified channel. As a peer reviewer, he has reviewed channel modification projects in North Carolina, Arizona, Illinois, Washington, and Texas. Dr. Brown has helped project economists derive traditional economic benefits from transportation savings, reduced emergency response costs, and reduced inundation costs. He has used all manner of site investigations on flood control, shore protection, and navigation projects, including standard penetration test borings, cone penetration test borings, downhole geophysical investigations, vibrocores, and test pits. Dr. Brown has used this information to determine channel modification depths, rock excavation requirements, and disposal estimates. For the Little Mill Creek project in Delaware, he determined the required depths of channel modification based upon the site investigation data. Dr. Brown was the primary design engineer for the modification of the Canaveral Harbor South Jetty, where he considered environmental impacts, natural geomorphology, and coastal processes to optimize the final modification design. Dr. Brown was also the lead geotechnical engineer evaluating both shore protection needs and dredging requirements in the Tampa Harbor complex. For this project, disposal of dredged material in open ocean environments, as beneficial beach fill material, and in upland confined disposal sites were all investigated. Dr. Brown has also worked as an expert witness, testifying in multiple trials involving differing site condition claims, foundation failures, and deficient designs. He has also testified in arbitration proceedings and in the International Court of Settlements. Dr. Brown has planning and design experience in Florida, Georgia, Delaware, Virginia, West Virginia, New Jersey, Delaware, Pennsylvania, and Puerto Rico. Dr. Brown teaches the water resources series of courses at UNF as well as the senior civil engineering capstone course. In the past, he has also taught engineering geology and foundation engineering. Dr. Brown has participated on several previous IEPR panels for multiple USACE districts. Dr. Brown is also fully capable of addressing relevant SAR issues and has fulfilled this requirement for at least four other IEPR projects, including the Olmsted Locks and Dam 52 and 53 Replacement Project Post Authorization Change Report and the Dallas Floodway Feasibility Report and Environmental Impact Statement (EIS), Dallas, Texas. Dr. Brown is active in the Society of American Military Engineers (SAME) and the American Water Resources Association; he is the faculty advisor to the University of North Florida SAME student chapter. He is also a former active member of the American Society of Civil Engineers.